The frame-less membrane: a novel technology for THz circuits

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A new GaAs based Schottky diode process development will be presented that allows one to implement supra THz frequency circuits in a radically improved fashion. We will illustrate the potential and capability of this technology by detailing the designs of a 1.2 THz tripler and a 2.4 THz doubler circuit. Both of these designs are currently being fabricated at JPL.

The improved concept to be presented builds on the already demonstrated membrane process for 2.7 THz mixers [1]. Realizing that the small size of the active devices at these frequencies might not require extensive mechanical support, the thick GaAs frame around the device/circuit has been eliminated. Meanwhile, all-gold beam leads are extensively used both for DC paths and mechanical/handling support. This technology allows many different types of circuit implementations which were previously not possible with existing technology. Both the 1.2 THz tripler and the 2.4 THz doubler are based on a balanced configuration and utilize split waveguide blocks. These circuits are being designed and fabricated for the FIRST HIFI local oscillator chains.

This technology allows designers to re-think their approach to high frequency circuits. However, it also involves some risk such as assembly and reliability, which will be addressed in the presentation. Finally, calculated performance of the circuits under consideration will be presented based on extensive device and structure simulations.

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[1] M.C. Gaidis, H.M. Pickett, C.D. Smith, R.P. Smith, S.C. Martin and P.H. Siegel, "A 2.5 THz Receiver Front-End for Spaceborne Applications," *IEEE Transactions Microwave Theory and Techniques,* vol. 48, no. 1, Jan. 2000.